



# 9210 & XPERT DATALOGGERS

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## GPRS Manual

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Part No. 8800-1194

Version 3.18

June 22, 2015

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## INTRODUCTION

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Sutron's Xpert family of DCPs (both the 9210 and the Xpert, hereafter referred to as the Xpert) have been designed to be easily expandable by adding additional software libraries, called Sutron Link Libraries (SLLs). One such library is GPRS.sll, which adds the ability for the Xpert to communicate using a Sutron GPRS modem connected to a serial port.

The GPRS.SLL permits TCP/IP access to or from the station, supports data messages in various formats, alarms, and SMS text messaging as well.

This document is the user manual for GPRS.sll. The following topics are discussed:

- How to install the library.
- How to configure the Xpert for GPRS communications.
- Diagnostics

## NEW FEATURES

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Initial release

# INSTALLATION

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This section describes the installation and configuration of the GPRS.sll library.

## Installation

GPRS.sll is required for GPRS operation. To install the library, copy the GPRS.sll file to the “\Flash Disk” subdirectory of your Xpert using Xterm. For more information on performing this file transfer, please refer to chapter 6 of the Xpert or 9210 user manual.

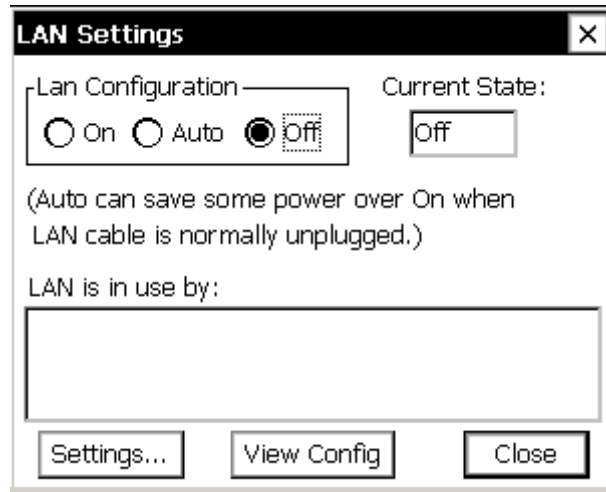
Once the files have been transferred, reboot the Xpert. The libraries will load automatically after the Xpert reboots.

To uninstall the libraries, use Xterm to delete the files from the Flash Disk subdirectory. This can only be done when the Xpert application is not running (select “Exit App” from the Status tab).

In order for the libraries to load and operate correctly, the versions of the files must be the same as the version of the application loaded into the Xpert. This is usually not a concern because the same versions of the slls and application are typically packaged together. Should the need arise to verify that the versions are the same; the version of a sll as it resides on the PC can be determined by looking at the file’s properties (right-click on the file and select the “Version” tab). The version of the Xpert application is given by the application itself, at the top of the About dialog, which is accessed from the Status tab.

## Before getting started

Typically the purpose of using the GPRS SLL is to provide internet services to an RTU and hence the LAN is not available and not used, but during initial testing setup it's very convenient to take advantage of it. The problem is that if the internal LAN is turned on then GPRS messages will be sent using the LAN and not the GPRS device. To avoid this you should just go to the LAN Settings Setup entry and turn it off.



**Figure 1: Turning the LAN off**

Configuring the serial ports for GPRS operation may require changes to the registry that will require a reboot before they take effect. When this situation can be detected, you will be notified of the need to reboot. However, it cannot always be detected. If you experience any difficulties establishing a connection when setting up a port for the first time, try rebooting the Xpert.

## FEATURES

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This section discusses what features are supported related to GPRS communications.

- Self-timed (scheduled) telemetry of data using TCP/IP messaging and/or SMS text messages
- Alarm telemetry of data using TCP/IP or SMS
- Support for standard Xpert network services when used with a VPN or static IP such as Telnet, Web Server, XTerm.
- Scheduled and manually initiated processing of incoming command messages
- Diagnostic support, including:
  - Scheduling details
  - Next self-timed message content and size
  - Recent incoming messages
  - Signal strength
  - Total message and byte counting
  - Projected data usage

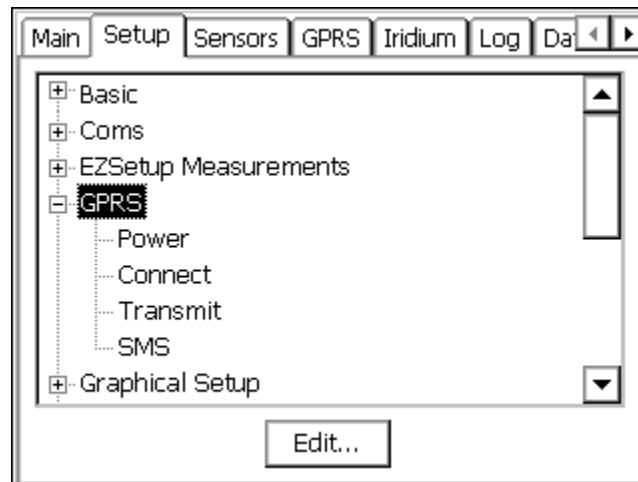
## CONFIGURATION

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This section discusses how to configure the Xpert to operate with the GPRS modem. There are three different places you'll go to use and configure the Xpert for GPRS communications:

- [GPRS Properties - Setup Tab](#)
- [GPRS Blocks - Graphical Setup and EzSetup](#)
- [Basic Entry - Setup Tab](#)

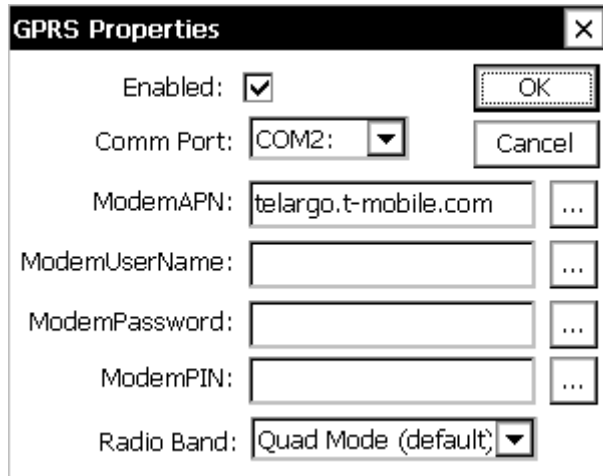
The first, and the one this section discusses in detail, is an entry under the Setup Tab named "GPRS". This entry is used to configure how Xpert talks GPRS over a selected communication port.



**Figure 2: The GPRS entry on Setup Tab**

### GPRS Properties

To access the dialog containing GPRS configuration properties, select the "GPRS" entry and press "Edit". The following dialog appears:



**Figure 3: GPRS Properties Dialog**

The GPRS Properties dialog contains setting for configuring the GPRS modem hardware. Here are the options provided by this dialog:

#### **Enabled**

This property must be set to YES to enable GPRS processing, including self-timed and alarm transmissions via GPRS and/or SMS communication, and command processing.

#### **Port**

This defines the serial port the GPRS device will be connected to. <None> will disable GPRS support. To use a serial port for GPRS you will need to make sure it's not already in use for something else. The port settings are fixed at 115200,n,8,1. With RTS/CTS hardware handshaking.

#### **ModemAPN**

The APN name is used to connect the modem to the internet. It varies based on the provider of the cell service. For T-Mobile, a typical value is "telargo.t-mobile.com"

#### **ModemUserName and ModemPassword**

These are used to login to the cell service provider. For some providers they can be blank, but otherwise use the value assigned by the provider or by Sutron.

#### **ModemPIN**

The SIM PIN unlock code. This must be specified if the SIM being used is locked. The GPRS Diagnostics Tab will warn if a SIM PIN is needed and hasn't been entered. Entering the wrong PIN can cause the modem to become blocked, so be carefully especially when swapping SIMs.

## Radio Band

The Sutron GPRS modem supports multiple bands. Typically in the US the “Quad Mode” can be used, but internationally you may need to select the specific band to prevent frequency hopping and/or roaming. Normally, when a modem is connected to the Xpert for the first time, it is factory reset and programmed to work with pre-configured settings. The “Use Modem Setting” may be used to bypass this initialization and use the settings that were pre-programmed in to the modem. This allows many of the modem settings to be customized in the modem. The “Janus T2 Modem” and the “Sutron HSDPA Modem” enables support for those specific 3G capable modems, but the settings are similar to the “Use Modem Setting” in that they use the band(s) which have been pre-configured in to the modem. If the default settings are unable to connect to the Cell provider, custom settings may be needed, and the manual(s) for the modem should be consulted. Typically the AT#BND and AT#AUTOBND need to be issued with the desired settings to configure the appropriate bands, and then the AT&W command must be issued to save the changes. Depending on the provider, some of the other settings such as AT#PLMNMODE, AT#ENS, and AT#SELINT) may need to be checked or changed.

## GPRS Power Settings

The GPRS power settings are accessed by selecting the “Power” item under GPRS in the Setup tab and clicking Edit. This dialog contains settings that determine when the GPRS modem should be powered on, how it should be powered on, and what it should do when powered on.

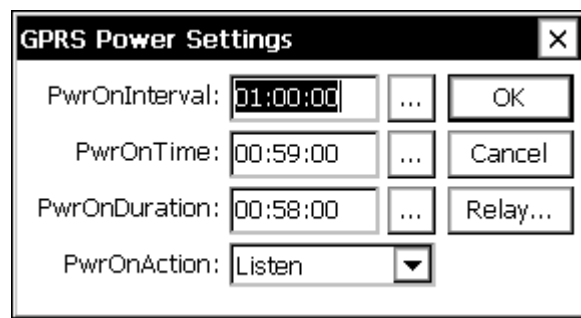


Figure 4: GPRS Power Settings Dialog

### PwrOnInterval + PwrOnTime + PwrOnDuration

PwrOnTime, PwrOnInterval, and PwrOnDuration are used to specify when the modem is powered PwrOnInterval specifies how often to power on, PwrOnTime specifies an offset to the interval, and PwrOnDuration specifies how long to stay powered.

For example, with PwrOnInterval = “01:00:00”, PwrOnTime = “00:30:00”, and PwrOnDuration = “00:15:00”, the modem will be powered on every hour at half-past the hour, and will stay powered for 15 minutes.

Also the GPRS modem generally needs to be reset to maintain health, which why even if the PwrOnTime, PwrOnInterval, and PwrOnDuration specify essentially a never-ending

By powering on the GPRS modem the user is given the ability to communicate with the Xpert over a TELNET, TCP/IP, SSP/CL, and SMS session via the master station. As well as send self-timed, and/ or alarm transmissions (this can be done without the power mode settings enabled too)

The primary reason to turn off the modem is to reduce power consumption, or limit time connected to the Cell network.

Please note that if the LAN is powered on at the same time that the GPRS is powered on, that the LAN will be preferred and may cause a conflict. This is similar to how when you enable WiFi on a cell phone, communications will whenever possible be routed using the WiFi interface and not the 3G.

### **PwrOnAction**

If set to “Connect” the modem will use the “PrimaryIP” address and connect to the master station using the port set for “Command Port” and establish an SSP/CL session according to the PwrOn schedule. This mode is meant as an option for one way systems.

For example, if the user was using Tempest and didn’t know the IP address of the GPRS modem but wanted to connect to it, the GPRS modem’s PwrOnAction would need to be set to “Connect” in order for the modem to connect to Tempest using a SSP/CL session.

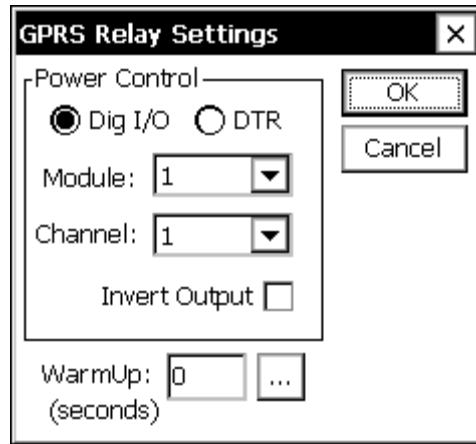
If set to “Listen” (the default setting) the modem will connect to any master station that initiates a connection. This is as long PwrOnInterval, PwrOnTime, and PwrOnDuration are set to power the GPRS at the time of this operation.

For example, if the user was using Tempest and knew the IP address of the GPRS modem and wanted to connect to it, the GPRS modem’s PwrOnAction would need to be set to “Listen” in order for the modem to connect to Tempest using a Telnet, or TCP/IP session.

Finally if a user connects to the unit remotely with one of the ways mentioned above, and the self-timed and /or alarm transmission fails to reach the master station the user will get logged out regardless of what the user timeout value is set to in the user settings.

### **GPRS Relay Settings**

The Relay... button brings up a further dialog which allows power to the modem to be controlled by a relay connected to a digital I/O point and to control the warm-up time.



**Figure 5: GPRS Relay Settings Dialog**

### **Power Control**

Power to Sutron's GPRS modem is supplied and managed using 12V DC (hardware selectable jumper) via PIN 9 of the RS232 port. In this case select DTR and enter a WarmUp delay of at least 10 seconds.

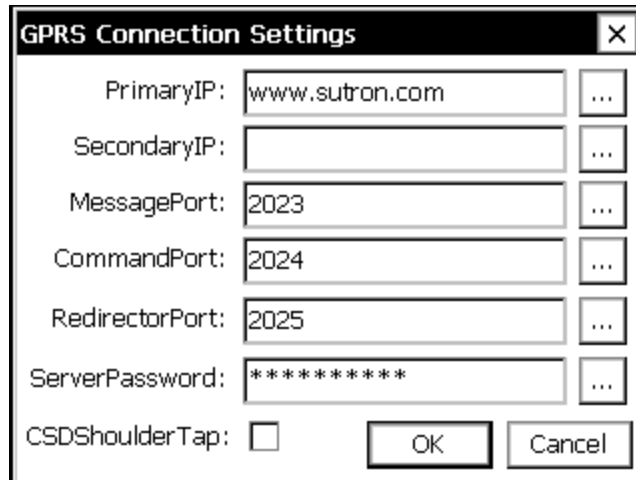
When using other modems it may be desirable to control power via a relay. When a connection is made, DTR is always asserted to the device. For non-Sutron modems which can enter standby mode when DTR is low this may be sufficient, but power to the device may be controlled by a digital switch or relay. When Dig I/O is selected, an I/O Module and Channel may be selected. This output will be turned “on” before a GPRS connection is attempted. The output is assumed to be open-collector, hence “on” means 0V is output. If the output instead uses positive logic, the “Invert Output” box may be checked.

### **WarmUp**

WarmUp is the number of seconds to allow the modem to warm up after asserting power before trying to establish a connection. It applies to both the Dig I/O and DTR settings.

## **GPRS Connection Settings**

The GPRS connection settings are accessed by selecting the “Connect” item under GPRS in the Setup tab and clicking Edit. This dialog contains settings that determine how the GPRS modem connects to TCP/IP based internet servers. These connections may be used for control or data transmission purposes.



**Figure 6: GPRS Connection Settings Dialog**

### **PrimaryIP and SecondaryIP**

Static IP's and VPN access are not always available, which means it will not always be possible for a server to establish a connection with the Xpert. To deal with this, the Xpert can be configured to initiate contact with a server and send messages or wait for commands.

When the GPRS modem initiates a connection to the master station, the Xpert tries using "PrimaryIP" up to a certain number of times, and then try "SecondaryIP" up to a certain number of times, with a few seconds pause between each attempt. The Xpert shall repeat this cycle until a connection succeeds.

### **MessagePort, CommandPort, and RedirectorPort**

The Xpert can connect to a master station for different purposes, and in order for the master station (and firewalls) to sort out that purpose specific TCP/IP ports are used. If you do not wish to use a service, you may specify 0 for the port value. The values entered here should agree with the values used by the master station and any firewalls in between:

- Message Port – used to receive self-timed and alarm transmissions from the Xpert in various ASCII data formats or SSP.
- Command Port – used for SSP/CL command processing, so that the user can change the setup, and view data in the Xpert directly through something like Tempest.
- Redirector Port – used for third-party SSP/CL communications redirected to Xpert, so the user can change the setup, and view data. An example would be if the user could not log onto Tempest directly, he or she can use something like a HyperTerminal session to communicate to the Tempest to contact the Xpert unit.

## ServerPassword

If not blank the GPRS Modem will use this password when accessing the server. This is used for authentication purposes.

## CSDShoulderTap

When enabled, CSDShoulderTap allows the user to call the modem using the phone number given to the GPRS SIM card. The modem then will connect to what's set to "Command Port" as long the modem can connect to the "PrimaryIP" or "SecondaryIP". This gives the user another way of making the GPRS modem connect to a master station such as Tempest.

The reason we have this settings is because if the user did not have a static ip address of the GPRS modem but had the phone number of the GPRS, he or she can call the number, or send a text with the command "STAP". By calling the number, or sending the text, and the Xpert is powering the GPRS using PwrOnTime, PwrOnInterval, and PwrOnDuration the GPRS will create a SSP/CL connection to the master station even if the GPRS's PwrOnAction = Listen. If sending a text the user will receive a text message saying "Created SSP/CL session to PrimaryIP(user set)"

## GPRS Transmission Settings

The GPRS transmission settings are accessed by selecting the "Transmit" item under GPRS in the Setup tab and clicking Edit. This dialog contains settings that determine how the GPRS modem transmits data to TCP/IP based internet servers.

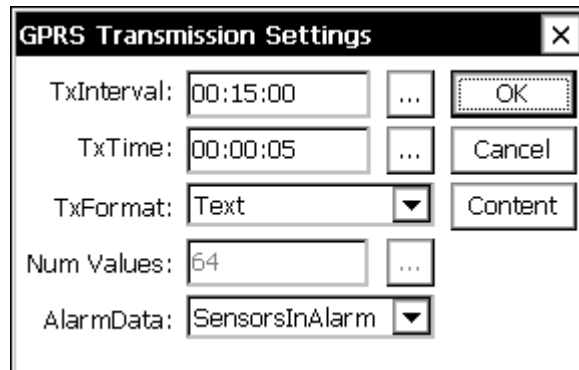


Figure 7: GPRS Transmission Settings dialog

### TxInterval

TxInterval defines how often to transmit self-timed messages. The format of the string is, "hh:mm:ss", where "hh" = hours, "mm" = minutes, and "ss" = seconds. For example, "01:00:00" means "every hour", while "00:30:00" means every half hour. Typical rates are 01:00:00 for hourly transmissions and 04:00:00 for transmissions every 4 hours.

### **TxTime**

This property defines an offset to TxInterval. It has the same format as TxInterval. A TxTime of “00:15:00” means, “15 minutes after the hour”. Some examples of transmission schedules are shown in the table, below:

TxInterval	TxTime	Transmission Schedule
01:00:00	00:00:00	12AM, 1AM, 2AM, ..., 12PM, 1PM, 2PM, ...
02:00:00	00:00:00	12AM, 2AM, 4AM, ..., 12PM, 2PM, 4PM, ...
01:00:00	00:30:00	12:30AM, 1:30AM, 2:30AM, ..., 12:30PM, 1:30PM, ...
04:00:00	00:15:00	12:15AM, 4:15AM, 8:15AM, 12:15PM, 4:15PM, ...

### **TxFormat**

This property defines the format of the data sent in self-timed transmissions (as well as alarm transmissions when AlarmData = “AllSensors”). The following formats are supported:

PseudoBin-B	6-bit “binary” format, interleaved
PseudoBin-B Non-Int	6-bit “binary” format, non-interleaved
PseudoBin-C	6-bit “binary” format, non-interleaved, with additional meta data
SHEF	ASCII human readable format using SHEF codes
SHEFFIX	ASCII human readable format using SHEF codes, where data appears in fixed width format of 7 chars
NIFC	ASCII human readable format based on NIFC requirements
NFRDS	ASCII human readable format based on NFRDS requirements
Handar	ASCII human readable format
SSP	Sutron Standard Protocol, binary format
Text	ASCII human readable text format, with alarm flags

See [Appendix A – Telemetry Formats](#), for detailed definitions of each of the formats.

### **Num Values**

When the selected format is interleaved (e.g., PseudoBin-B), the number of data values to include for each selected data item must be the same for all selected items, and so is entered in this dialog (rather than where it is normally entered, in the GPRS telemetry block properties).

For example: if Num Values is 4, and GPRS blocks tag the two data points, “HG” and “HF”, then the last 4 values of HG and HF appear in the transmit message.

## AlarmData

AlarmData can be either “SensorsInAlarm” or “AllSensors”. When set to the latter, alarm transmissions contain the same data as is found in self-timed transmissions, i.e., all data tagged with an GPRS block in the Graphical Setup (as well any data points tagged in EzSetup). However, when AlarmData is “SensorsInAlarm”, only the data *triggering the alarm* is included in the transmission.

## Content

When you press the Content button on the GPRS Transmission Settings dialog, the “Set Tx Content” dialog opens showing a list of all GPRS blocks in the Graphical Setup (as well as any data points tagged in EzSetup).

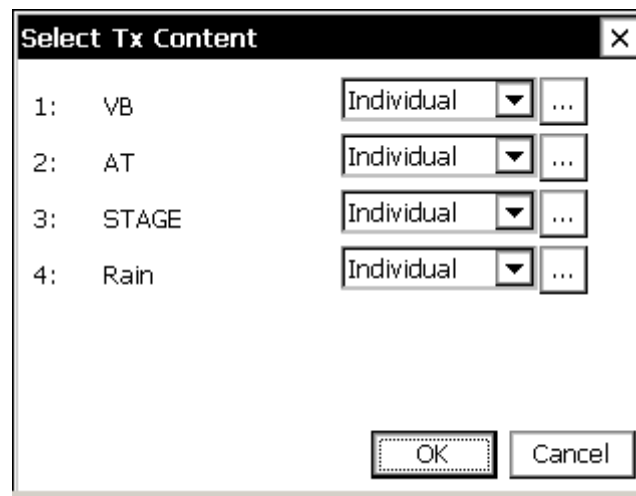


Figure 8: Select Tags dialog

When more entries exist than can be shown in the dialog, scroll bars appear, allowing you to scroll to other entries.

From this dialog, you can change the value of the “TxContent” property for each data item in the list. You can also press the “...” button to access and change other properties in the block’s properties dialog.

## GPRS SMS Settings

The GPRS SMS settings are accessed by selecting the “SMS” item under GPRS in the Setup tab and clicking Edit. This dialog contains settings that determine how the GPRS modem transmits manages sending and receiving SMS text messages.

**Figure 9: SMS Settings**

### **TxMode**

TxMode allows the user to receive self-timed transmissions using SMS communication. An example of this is when wanting to receive self-timed transmissions through your phone.

When TxMode is set to “Scheduled”, and TxList has a phone number in it the user will receive text messages with self-timed transmissions every time a self-timed transmission is supposed to occur based on TxInterval, and TxTime in GPRS Transmission settings. If the self-timed transmission does not get through to the master station, the SMS self-timed transmission will be delayed due to the retries, but will still be attempted.

When TxMode is set to “Fallback”, and TxList has a phone number in it the user will receive text messages with self-timed transmissions every time a self-timed transmission doesn’t get through to the master station using the GPRS link. While it’s not always possible there are circumstances where a GSM SMS text message can get through when a GPRS data transmission cannot.

The format of the SMS self-timed transmission will be based on the TxFormat set in GPRS settings. Expect if the format is “SSP” due to it being in binary – in that case “Text” will be used.

**CAUTION:** SMS transmissions whether scheduled or fallback are limited to 160 bytes of data. Users will have to limit their data sent per transmission or else the SMS message may not be able to contain it all.

### **TxList**

Allows to user to choose what phone numbers get the self-timed, and alarm transmissions based on what TxMode, and/or AlarmEnable is set too. Separate phone numbers with a comma “,”.

## Alarms

When Alarms is checked and TxList has a phone number in it, the Xpert shall also send alarm messages via SMS. The SMS message is human readable, and includes the station name so the user does not need to know the station identified by the phone number. The time is also included to account for the delays in delivery. The date is not included as the delays are expected to be short. The alarm transmissions format of what sensor data gets sent is based on whether the user set AlarmData to “All Sensors”, or “Single Sensor”.

An example of the Text format used for SMS alarm messages:

```
RTU01 12:22<cr><lf>
STAGE 4.55 G H+R+<cr><lf>
RAIN 2.0 G OK<cr><lf>
```

The message begins with the station’s name (“RTU01”) and the current time in HH:MM (12:22) format followed by a list of sensor readings containing the name of the sensor (“STAGE”), the value (“4.55”), the quality (“G”), and the alarm status (“H+R+”).

In the above example "H+R+" indicates that STAGE is experiencing a high limit and high rate of change alarm, while the “OK” status for RAIN indicates that it is within expected limits.

Quality codes:

G: Good quality  
B: Bad quality  
U: Undefined quality

Alarm codes:

H: High limit exceeded  
L: Low limit exceeded  
R: High Rate of change  
OK: Normal

A “+” after a code indicates that the sensor has just entered that state, while a “-” after a code indicates that the sensor has just exited that state.

**CAUTION:** SMS alarm transmissions are limited to 160 bytes of data. Users will have to limit their data sent per transmission or else the SMS message may not be able to contain it all.

## Notify

The Xpert shall report the following events via SMS to the list of phone numbers in NotifyList:

- Station Rebooted – Indicates that the Xpert unit has rebooted

- Recording on/off – Indicates that the Xpert unit has turned recording on (Recording on), or recording off(Recording off)
- GPRS connect failure - Indicates that GPRS services may not currently be available (a given cell tower may support GSM/SMS services but not GPRS), or that there's something wrong with the APN settings, the account, the provider, etc.
- Shoulder tap failure - If GPRS is unable to perform a shoulder tap that's been requested by the user using SMS, the command line, or by ringing the cell modem (CSDShoulderTap=Yes), then it should send an "STAP failed (could not connect)" SMS notification message. The shoulder tap requires making a TCP/IP connection to the IP and port specified by the command or the primary IP and command port if other settings were not supplied.

### **NotifyList**

Allows to user to choose what phone numbers get the SMS notification for SMSNotifyEnable's events. Separate phone numbers with a comma ",".

### **SetupPassword and DataPassword**

These two properties specify authorization codes used to validate incoming command messages. SetupPassword specifies the authorization code for "setup-level" access, while DataPassword specifies the authorization code for "data-level" access.

Incoming command messages have setup-level access by default. When the SetupPassword property contains an authorization string, any and all incoming messages that normally require setup-level access to be processed must prefix the command with the authorization code. For example, to command the station to reboot with an authorization code of "MyAuthCode", the incoming message content would be "MyAuthCode reboot".

### **SetupUserList and DataUserList**

These two properties are authorization settings that require the phone number stated in the Authlist to be used to validate incoming command messages. Both SetupUserList and DataUserList are only enabled in addition to the SetupPassword and DataPassword being enabled.

A better explanation about how it's used is if the SetupUserList property specifies a phone number, while SetupPassword is blank, then a user from any phone number can send a setup command with no code, and the command will be processed. However if SetupUserList property is blank, while SetupPassword has a code, then the user must have the code, regardless of his phone number.

For example if he or she wants to send the reboot command he or she needs to use the SetupPassword string, as well send the SMS message with command from the phone number listed in SetupUserList.

SMS command = Reboot  
SetupPassword = sutron

SetupUserList = 555-555-5555

Phone used(888-888-8888) & sending the command = sutronReboot

Response from GPRS modem = invalid authorization

Phone used(555-555-5555) & sending the command = sutronReboot

Response from GPRS modem = command processed and system rebooted

### **SMS command processing**

If the user wants to change the setup in the GPRS settings or gather status information about the Xpert from the GPRS modem he or she can use their phone to do it. The following commands are supported via SMS:

- Call home (shoulder tap): connect to SSP/CL  
-STAP [url[:port]]
- Call home with optional IP/Port: connect to redirector port specified  
-REDIR [url[:port]]
- To set (or show if a setting isn't provided) the PrimaryIP, SecondaryIP, MessagePort, CommandPort, RedirectPort. The URL and PORT values are user input  
-SETPIP [url]  
-SETSIP [url]  
-SETMP [port]  
-SETCP [port]  
-SETRP [port]
- Check power status, or turn power temporarily on or off until the next power cycle:  
-POWER [ON|OFF]
- Command-line commands

Any responses that are generated as a result of the command shall be sent via SMS to the original sender. The responses shall be limited in length by the max SMS message length.

Also if the SetupPassword, and/or DataPassword are enabled, the user must type the authcode string before the command in order for authorization of the command to happen.

An example:

SetupPassword : **sutron**

On the phone send a text message to phone number of the GPRS modem with the command "Reboot" and the authentication code like this:

**sutron reboot**

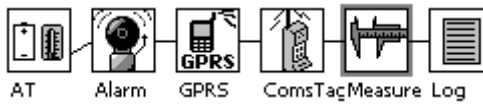
Also if the SetupUserList is enabled the user must send the command with the authorization code from that specific number listed in the SetupUserList. But be aware that if there is no SetupPassword enabled, then it doesn't matter if SetupUserList has a phone number because the user can send the command from any phone and change the setup of the GPRS modem.

This functionality was setup for a user that couldn't communicate with the GPRS over VPN or Public IP. It gives the user the almost the same abilities as if he or she were using the master station to communicate to the GPRS modem.

## Selecting Data for Transmission with the GPRS block

Sensor data can be tagged for transmission in two ways using either the Graphical Setup, or the EzSetup. The properties are the same, whether you are working in the Graphical Setup or EzSetup.

Using the Graphical Setup, you need to attach a GPRS block (found under the Telemetry category) to an output you'd like to have transmitted, and then configure the block. Here's an example of the order we suggest that the blocks be created and connected together:



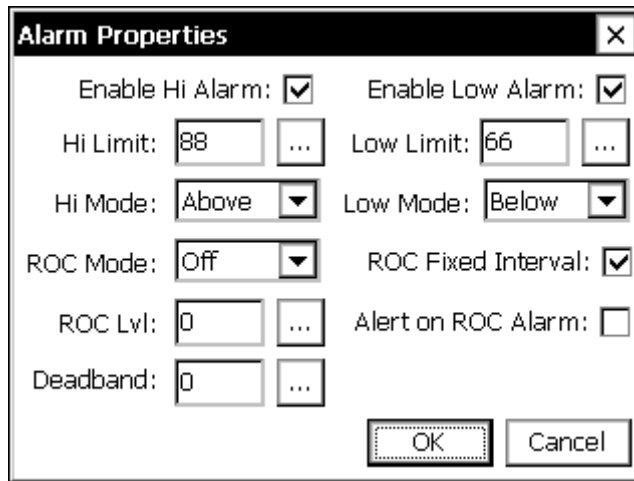
**Figure 10: GPRS block in Graphical Setup**

In the setup depicted above, the GPRS block tags a measured data point, that of, Air Temp (AT). Here are some important notes about the setup:

- The GPRS block appears after Alarm block. This ensures the GPRS block “sees” the result of the alarm evaluation, triggering alarm transmissions, if needed. Of course, the Alarm block is only required if your system will evaluate data for Alarm and/or alarm transmissions.
- The GPRS block appears before the ComsTag block. This ensures the ComsTag “sees” the alarm transmission status generated by the Alarm and GPRS blocks.
- The ComsTag block is required for SSP telemetry, but even when not using the SSP format it allows the value to be displayed on the Data tab and/or accessed via the command prompt and SMS commands.

## Alarm Block Properties

The Alarm block is a standard block used to define high limits, low limits, and rate of change. The block is discussed in detail in the Xpert manual, but one interesting feature to note is that Alarm blocks may be strung together to handle multiple conditions.



The **Alarm Properties** dialog box contains the following settings:

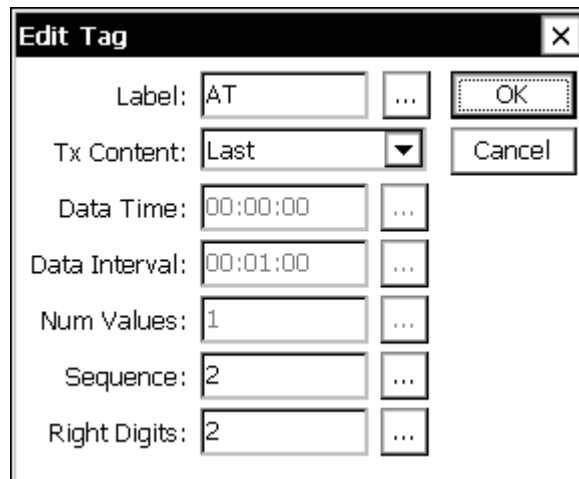
- Enable Hi Alarm: ☒
- Enable Low Alarm: ☒
- Hi Limit: 88
- Low Limit: 66
- Hi Mode: Above
- Low Mode: Below
- ROC Mode: Off
- ROC Fixed Interval: ☒
- ROC Lvl: 0
- Alert on ROC Alarm: ☐
- Deadband: 0

Buttons: OK, Cancel

**Figure 11: Alarm Block Dialog**

### GPRS Block Properties

To view and edit the properties of the GPRS block, tap the block and select “Edit Properties” in the pop-up menu that results (in EzSetup, simply press the GPRS button). The following dialog is shown:



The **Edit Tag** dialog box contains the following settings:

- Label: AT
- Tx Content: Last
- Data Time: 00:00:00
- Data Interval: 00:01:00
- Num Values: 1
- Sequence: 2
- Right Digits: 2

Buttons: OK, Cancel

**Figure 12: GPRS Edit Tag Dialog**

The GPRS Edit Tag dialog is used to edit the properties of the GPRS block that “tags” the data point for transmission.

### Label

Label defines the “name” of the data. Some formats (e.g., SHEF) include this Label in the transmission.

## TxContent, DataInterval, DataTime, NumValues

These properties define what data to include in the transmission. See the following table for details:

Tx Content		Description of data to transmit
All		All the data logged for the output since the last transmission will be transmitted
Individual		Individual values logged for the output since the last transmission will be transmitted.
	Data Interval	The time interval between readings. For example, "01:00:00" means "hourly data"
	Data Time	The time, or offset into the interval, of the data to include. For example, "00:15:00" means "include data measured on a 15 minute offset"
	Num Values	Number of values for each data item to include in the transmission
Last		Only the last value measured will be transmitted
Exclude		Do not transmit this output

## Sequence

This property determines the order of the data item within the transmission.

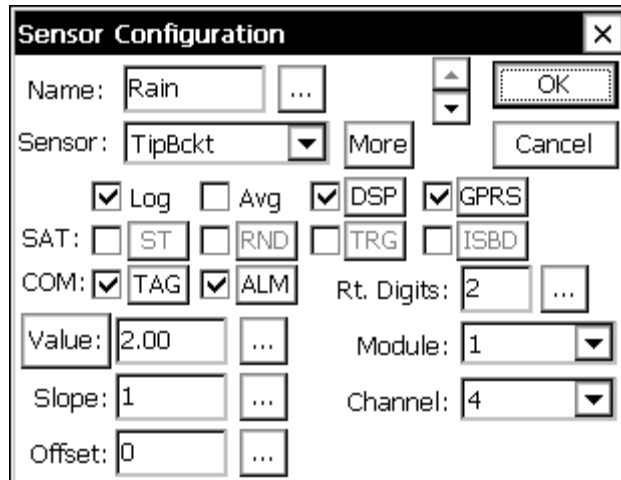
## Right Digits

This property determines the number of right digits to include in the transmission. These properties determine what data is included in transmissions, and its sequence in the transmission (if applicable to the selected format). The value of *Tx Content* can be *All*, *Individual*, *Last*, or *Exclude* as described below. Setting Tx Content will enable or disable other properties:

Note: When Pseudobinary B (an interleaved format) is the selected format, the user defines a Num Values setting for all outputs in the [GPRS Transmission Settings Dialog](#), and the meaning of the Tx Content property on each output changes: A Tx Content value of "Last" no longer means just the last value, but the last *Num Values* values. A Tx Content value of "All" no longer means all values since last transmission, but all values up to *Num Values*.

## Tagging Data with EzSetup

Tagging data for GPRS transmission in EzSetup requires placing a check next to the GPRS button and then pressing the GPRS button to select the properties.

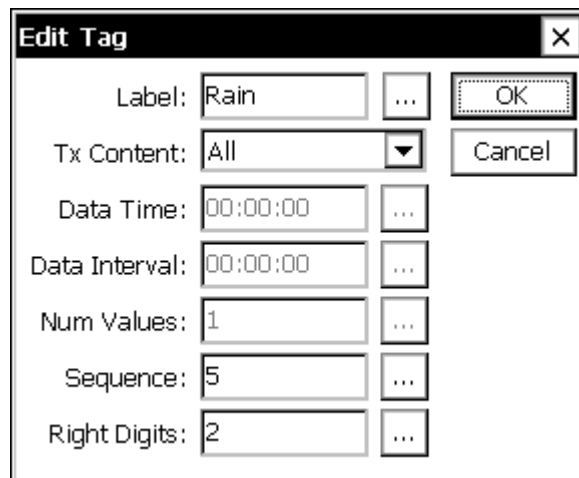


The **Sensor Configuration** dialog box contains the following fields and controls:

- Name:** Text box with "Rain" and an ellipsis button.
- Sensor:** Dropdown menu with "TipBckt" and a "More" button.
- Log:** Checked checkbox.
- Avg:** Unchecked checkbox.
- DSP:** Checked checkbox.
- GPRS:** Checked checkbox.
- SAT:** Unchecked checkbox.
- ST:** Unchecked checkbox.
- RND:** Unchecked checkbox.
- TRG:** Unchecked checkbox.
- ISBD:** Unchecked checkbox.
- COM:** Checked checkbox.
- TAG:** Checked checkbox.
- ALM:** Checked checkbox.
- Rt. Digits:** Text box with "2" and an ellipsis button.
- Value:** Text box with "2.00" and an ellipsis button.
- Module:** Dropdown menu with "1".
- Slope:** Text box with "1" and an ellipsis button.
- Channel:** Dropdown menu with "4".
- Offset:** Text box with "0" and an ellipsis button.
- Buttons:** "OK" and "Cancel" buttons.

**Figure 13: EzSetup Configuration**

Pressing the GPRS button will bring up the same [GPRS Block Properties Dialog](#) as described above:



The **Edit Tag** dialog box contains the following fields and controls:

- Label:** Text box with "Rain" and an ellipsis button.
- Tx Content:** Dropdown menu with "All".
- Data Time:** Text box with "00:00:00" and an ellipsis button.
- Data Interval:** Text box with "00:00:00" and an ellipsis button.
- Num Values:** Text box with "1" and an ellipsis button.
- Sequence:** Text box with "5" and an ellipsis button.
- Right Digits:** Text box with "2" and an ellipsis button.
- Buttons:** "OK" and "Cancel" buttons.

**Figure 14: GPRS Tag in EzSetup**

## Basic Entry – Setup Tab

A Basic program can format custom GPRS messages. Any of the Basic string functions can be used to format the buffer as required, but the Bin and Bin6 functions exist specifically to help forming 8-bit and 6-bit binary encoded data.

To create a self-timed formatting routine, create a function with a "SELFTIMED\_" prefix. The return value of the function becomes the buffer. For example:

```
Public Function SELFTIMED_STFormatter
    Selftimed_STFormatter = "Test Selftimed Message"
End Function
```

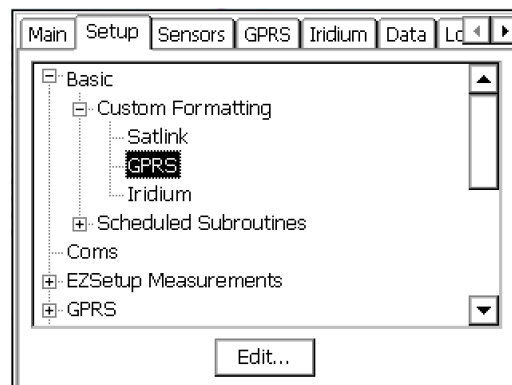
To create an alarm formatting routine, create a function with an “ALARM\_” prefix and a single parameter in which the group number will be passed. The return value of the function becomes the buffer. For example:

```
Public Function ALARM_Formatter(Group)
    ALARM_Formatter = "Test Alarm Reporting Message: " +
    Str(Group)
End Function
```

It's possible to append to the buffer, as opposed to simply overwriting it, by taking advantage of string concatenation. The following example appends its message to the current buffer:

```
Public Function SELFTIMED_STFormatter
    SELFTIMED_STFormatter = SELFTIMED_STFormatter + "Test
Selftimed Message"
End Function
```

More than one formatting function can exist in your program, but only one self-timed and one alarm function may be active at one time. The active routine is selected in the Iridium Custom Formatting entry under Basic, on the Setup tab:



**Figure 15: GPRS Custom Formatting Entry**

## TESTING GPRS OPERATIONS

This section describes how the GPRS Diagnostics Tab may be used to test out GPRS communications.

### The GPRS Diagnostics Tab

The GPRS Diagnostics Tab may be used to test communications over GPRS, and examine the communication status.

The screenshot shows the GPRS Diagnostics Tab interface. At the top is a menu bar with buttons for 'Main', 'Setup', 'Sensors', 'GPRS', 'Iridium', 'Log', and 'Data'. The 'GPRS' button is highlighted. Below the menu bar, the interface displays several fields and buttons: 'Modem status: Standby-Off' with a 'Tests...' button to its right; 'Next task: PwrOn'; 'Next task time: 19:59:00' and '19:57:26'; 'Last SMS: No messages' with a 'More...' button to its right; 'Signal quality: [four bars]' with an 'Update' button and a 'Bars' dropdown menu; 'Power control: ON' and 'OFF' buttons; and at the bottom, 'Selftimed statistics...' and 'Alarm statistics...' buttons.

Figure 16: GPRS Diagnostics Tab

### Modem status

Modem status describes the current state of GPRS processing, and may be any one of the values in the following table:

Status	Description
Alarm Tx	Alarm transmission in progress
App Stop	System is being shutdown
Comm Error!	An error has occurred talking to modem (check connection to modem)
DailyMaint	System is storing and resetting daily counts
Disabled-Off	GPRS is disabled and off
Disabled-On	GPRS is disabled, but power is still on
Force Power Off	The “OFF” button was pressed in the GPRS Diagnostics Dialog
Force Power On	The “ON” button was pressed in the GPRS Diagnostics Dialog
GPRS Denied	A connection to the GPRS network could not be made
GPRS Ignore	A GPRS connection could not be established, and the Xpert is moving

	forward with GSM support, but will still try to establish a GPRS connection as needed
GPRS Ready	GPRS is registered
GPRS Roaming	GPRS could not establish a connection to the home network and is currently roaming on a partner network.
GPRS Search	GPRS is still trying to establish a connection to a tower
GSM Denied	A connection to the GSM network could not be made
GSM Ready	GSM is registered
GSM Roaming	GSM could not establish a connection to the home network, and is currently roaming on a partner network.
GSM Search	GSM is still trying to establish a connection to a tower
Modem Chg	A change to the modem settings has been made and is being applied
Power Off	Modem is powering off
Power On	Modem is powering on
Property Chg	A setup change is taking effect
Reconnect	A GPRS connection unexpectedly dropped and is being reconnected
Reschedule	A setup change requires events to be rescheduled
SelfTimed Tx	Self-timed transmission in progress
Send Alarm	An alarm tx is being scheduled
SMS Notify	An SMS notification message is being sent
SSP/CL Chg	A change to the SSP/CL and/or Transmission settings has been made and is being applied
Standby-Off	Modem is not powered, and is ready for next task
Standby-On	Modem is powered up due to the power settings, and is ready for next task.
Standby-On*	Modem is powered up to handle a temporary condition such as transmission outside the normal power-up cycle, an alarm transmission, or a call back operation.
Starting	System is starting up
Stopped	GPRS processing has stopped (no transmissions will occur)
Stopping	System is stopping

In addition while a GPRS network connection is being established there are additional status messages that may be display during the process as follows:

<b>Network Connection Status</b>	<b>Description</b>
All Devices Connected	A network link has been established
Authenticated	The network link has been authenticated
Authentication Acknowledged	A request for authentication is being acknowledged
Authentication Notify	Authentication is needed
Authentication Retry	Authentication with different credentials has been requested
Connected	Network connection has been established
Connecting Device	A connection is about to be started
Device Connected	A connection has been made to the modem (not the network)
Device Setup	The modem port is being configured
Disconnected	The connection has been terminated or failed
Opening Port	The modem port is being opened
Password Expired	Password has expired
Retry Authentication	Retrying authentication
Starting Authentication	Authentication is being performed

### **Tests...**

Pressing this button will bring up the [GPRS Test Dialog](#) (see below).

### **Next task**

The next task that's scheduled to occur and may be: Nothing, DailyMaint, PwrOff, PwrOn, Reschedule, SMSNotify, SelfTimed, Alarm, Reconnect, or AppStop.

### **Next task time**

Contains the time that the next task is scheduled to start

### **Time**

The current time is displayed as a reference

### **Last SMS**

Displays the last SMS text message received

**More...**

If multiple text messages have been received, pushing this button will display the last 5.

**Signal Quality**

Displays the last measured cell signal strength in terms of bars, or in dBm with % bit error rate. The dBm value can range from -51 (strong) to -113 (weak). For reference -75 is considered “5 bars”, and -105 is considered “2 bars”. The bit error rate will vary from 0.2% (best) to 12.8% (worst). Often the bit error rate is a better indicator of quality than signal strength.

**Update**

Pressing the Update button will cause the signal strength to update for 2 minutes or until the button is pressed again. As it updates, a tone is output by the Xpert that’s proportional to the signal strength. The higher in frequency, the better the signal. This can be used to aid in aiming the antenna.

**ON**

Pressing “ON” turns the GPRS radio on until the next scheduled off time.

**OFF**

Pressing “OFF” turns the GPRS radio off until the next scheduled on time. GPRS will still turn on as needed for transmissions.

**Selftimed statistics...**

Displays the following information about self timed transmissions:

Last Tx, #Tx Today, Next Tx Time, Next Tx msg, Next Tx size, Est #Tx bytes/day, and #Tx bytes today.

The estimate #Tx bytes/day can be used to help estimate the data budget for a station, but as it doesn’t include overhead it will be significantly low.

**Alarm statistics:**

Displays the following information about alarm transmissions:

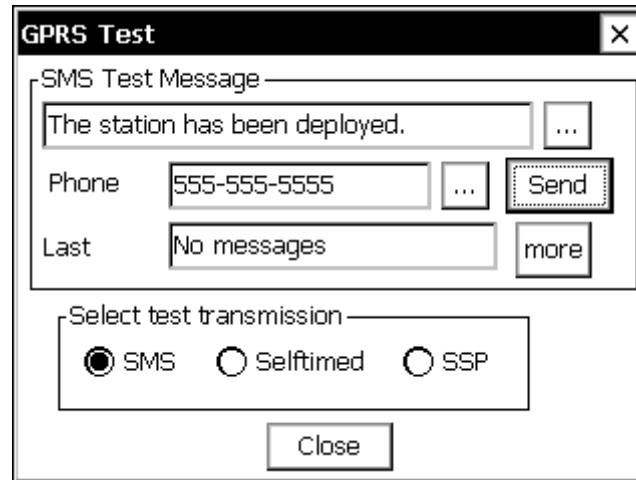
Last Tx, #Tx today, #Tx bytes today.

**GPRS Test Dialog**

The GPRS Test Dialog is used to send test transmissions using SMS, Selftimed, or SSP messaging. Select the type of transmission, enter a test message (and other related information), and press Send.

## SMS Test Transmission

The SMS Test Transmission screen is used to verify SMS text message operation. SMS messaging requires GSM services – which may operate in areas where GPRS service is not available.



The screenshot shows a dialog box titled "GPRS Test" with a close button (X) in the top right corner. Inside the dialog, there is a section labeled "SMS Test Message" containing a text input field with the text "The station has been deployed." and a button with three dots "...". Below this, there is a "Phone" label followed by a text input field containing "555-555-5555" and a button with three dots "...". To the right of the "Phone" field is a "Send" button. Below the "Phone" field is a "Last" label followed by a text input field containing "No messages" and a "more" button. At the bottom of the dialog, there is a section labeled "Select test transmission" with three radio buttons: "SMS" (which is selected), "Selftimed", and "SSP". A "Close" button is located at the very bottom of the dialog.

Figure 17: SMS Test Transmission

The fields in the SMS Test Transmission Dialog are defined as follows:

### SMS Test Message

Enter a message to send.

### Phone

Enter the phone number to send the SMS message.

### Send

Send the message

### Last

The last SMS message received

### More

The last 5 SMS messages received

### Select test transmission

Select SMS

## Selftimed Test Transmission

The Selftimed Test Transmission screen is used to verify GPRS messaging. An ASCII message is sent to the server using the “session type 0” header.

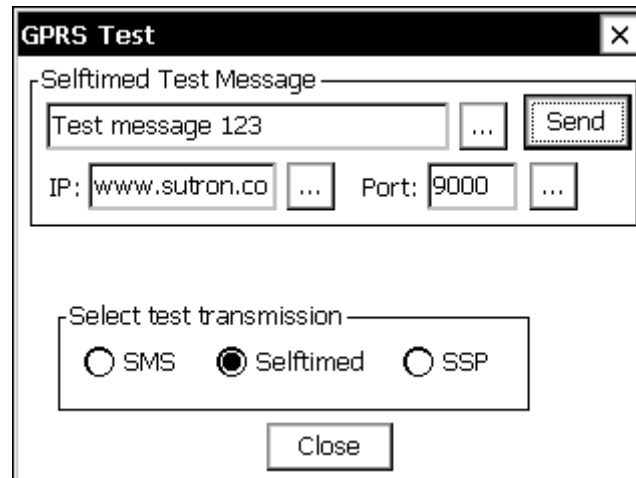


Figure 18: Selftimed Test Transmission

The fields in the Selftimed Test Transmission Dialog are defined as follows:

### Selftimed Test Message

Enter a message to send.

### IP

Enter the IP address or URL of the server that is to receive the message.

### Port

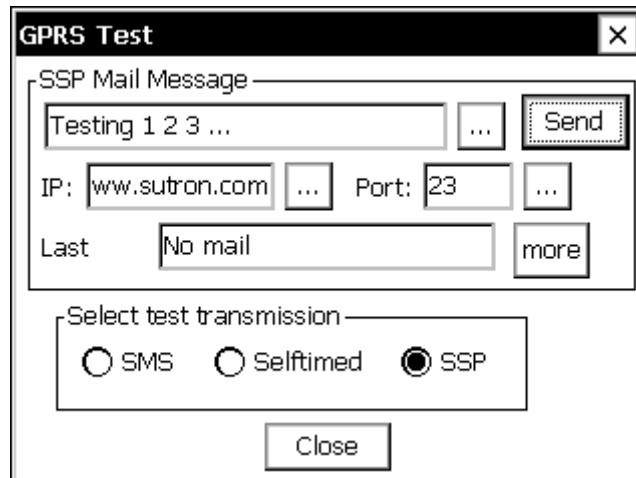
TCP/IP port number of the service handling Selftimed messages on the server

### Select test transmission

Select Selftimed

### SSP Test Transmission

The SSP Test Transmission screen is used to verify SSP messaging over GPRS, by transmitting an SSP mail message to the specified server (or RTU) and verifying that the message was acknowledged.



**Figure 19: SSP Test Transmission**

The fields in the SSP Test Transmission Dialog are defined as follows:

### **SSP Test Message**

Enter a message to send.

### **IP**

Enter the IP address or URL of the server (or RTU) that is to receive the message.

### **Port**

TCP/IP port number of the service handling SSP messages on the server. The default SSP service on an RTU is the Telnet service which used port 23.

### **Send**

Send the message

### **Last**

The last SSP message received

### **More**

The last 5 SSP messages received

### **Select test transmission**

Select SSP

## TROUBLESHOOTING

---

1. Did you check to make sure that Remote, Coms, Basic, or any other part of the system isn't trying to use the com port you wish to use for GPRS? Issuing "status" at the command prompt will list all ports that Remote has been configured to support.
2. Did you check to make sure the LAN device is turned off?
3. If you just configured a serial port for the first time, have you tried rebooting the unit?
4. Observe the GPRS Diagnostics Tab while a connection is attempted and verify that connections are being scheduled, and watch for an issue during the connection negotiation.
5. Verify that the GPRS device is being powered up correctly by pressing ON in the GPRS Diagnostics Tab.
6. Issuing "report high" or even "report debug" at the command prompt is a good way to get real time diagnostic information about the performance of the GPRS SLL and the system in general. You can monitor SSP messaging by issuing "report ssp". SSP over TCP/IP messages may be viewed by issuing "report ssp0", or the options may even be combined by issuing "report ssp ssp0".
7. The system status page will show information about the most recent diagnostic messages and the current state of the GPRS device. This can also be displayed on demand at the command prompt with the "info" command.
8. The system.log can be examined to look for status messages, connection errors, and transmission errors.
9. Use the GPRS Diagnostic page to send test mail messages.
10. If you need to reach your station for maintenance, but it's configured to turn on only when transmitting, you may try sending the SMS command "POWER ON" to the station. The SMS command won't be able to go through while the modem is powered off, but it may get through on a retry or if you happen to time it for when the station is transmitting.
11. Contact Sutron Customer Support at 703-406-2800.

## APPENDIX A – TELEMETRY FORMATS

---

This appendix contains descriptions for each of the telemetry formats supported by Xpert Iridium.

### Handar Format

The Handar format is an ASCII, human readable format where sensors are separated by <CRLF>, sensor data is separated with a space, and missing data is reported as “M”.

For example:

```
010034380517419:21:30G42+0NN155E9200070"
1.3 1.3 1.3 1.3
2.4 2.4 2.4 2.4
M 12.2 12.2 12.2 12.2 12.3 12.3 12.3
```

### NFDRS and NIFC Formats

The NFDRS (National Fire Danger Rating System) and NIFC (National Interagency Fire Center) formats produce reports of human readable ASCII values using SHEF codes as labels for data.

The labels applied to measurement outputs are used to identify the data to include in the report. The following table shows what labels are recognized by the NIFC and NFDRS formatter. An “x” means the sensor label must appear in the setup for the formatter to succeed. The items with no “x” are recognized and will be formatted, but are not required.

Sensor	Label	NIFC	NFDRS
Rainfall	PCH	x	x
10-Min Avg Wind Spd	USH	x	x
10-Min Avg Wind Dir	UDH	x	x
Air Temperature	TAH	x	x
Fuel Temperature	MTH	x	
10-Min Avg Rel Hum.	XRH	x	x
Battery Voltage	VBH	x	x
Barometric Pressure	PAH		
Peak Wind Direction	UGX		
Peak Wind Speed	UPH		

Fuel Moisture	MMH		
Solar Radiation	RDH		x

Here's an example NIFC telemetry report:

00.00

000

270

328

110

100

14.0

000

000

020

0486

Here's an example NFDRS telemetry report:

00.00

000

270

328

110

100

14.0

000

000

020

0486

Note how there are no labels in the report. This is because the position of the data within the report determines the source of the data.

# Pseudobinary Formats

Pseudobinary formats produce ASCII reports of 6-bit pseudo-binary formatted data values. The formats are “pseudo”-binary, because each sensor value is expressed in the range of ASCII characters, but not in such a way that is readily human-readable.

## Pseudobinary B (Interleaved and Non-Interleaved)

The Pseudobinary-B Interleaved format is identical to the 8210 binary transmission format. “Interleaved” means the most recent values of all sensors come first, followed by the next most recent, and so on. “Non-interleaved” means all the data for sensor 1 is followed by all the data for sensor 2, and so on, i.e., the data is not “interleaved” according to time.

This pseudobinary format cannot be easily read by a person. Here's is an example message:

```
B l @ @ G t @ S x @ e i @ G s @ S r @ e i I
```

```
└─ Block ID  
  └─ Group ID  
    └─ Stage #1  
      └─ Temp #1  
        └─ Precip #1  
          └─ Battery Voltage  
    └─ Stage #2  
      └─ Temp #2  
        └─ Precip #2  
          └─ Battery Voltage  
  └─ Delta Time  
    └─ Precip #1  
      └─ Battery Voltage  
    └─ Precip #2  
      └─ Battery Voltage
```

## Pseudobinary-B Format

Name	Bytes	Description
Block ID	1	BLOCK-IDENTIFIER is always sent as "B" to indicate that this is the pseudobinary B format.
Group ID	1	GROUP-ID can be "1" to indicate a scheduled transmission, "2" meaning an alarm transmission, and "3" indicating a forced transmission.
Delta Time	1	Age in minutes of the most recent data
Data	3x num sensors	Data in either interleaved, or non-interleaved format. The example above shows the data interleaved (most recent of all sensors followed by next oldest, and so on). See the section below, "Six-Bit Binary Encoded Format" for details on how these values are encoded.

Battery Voltage	1	Logger battery voltage measured just prior to transmission
-----------------	---	--

### Pseudobinary-C Format

The Pseudobinary-C format also produces an ASCII report of 6-bit pseudo-binary formatted values, but with additional fields to describe label and time information. Just as the “B” version of the format, this format is “pseudo”-binary, because each sensor value and descriptor is expressed in the range of ASCII characters, but not in such a way that is readily human-readable.

#### Pseudobinary-C Format

Name	Bytes	Description
Block ID	1	BLOCK-IDENTIFIER is always sent as "C" to indicate that this is the pseudobinary C format.
Group ID	1	GROUP-ID can be "1" to indicate a scheduled transmission, "2" meaning an alarm transmission, and "3" indicating a forced transmission.
Measurement Delimiter	1	This byte is always a "+" and it is used to denote the start of measurement data.
Measurement Index (Sequence)	1	The Sequence number assigned by user in the output telemetry settings. This value is encoded 6 bit binary. Typically, the sequence number assigned is unique, allowing you to uniquely identify the data point.
Day	2	This 2 byte encoded 6 bit binary encoded number represents the Julian day of the year. The day tells when the most recent (first) sensor reading of this measurement was made.
Time	2	This 2 byte encoded 6 bit binary encoded number is a number of minutes into the day. It tells when the most recent (first) sensor reading of this measurement was made.
Interval	2	This 2 byte encoded 6 bit binary encoded number tells the measurement interval in minutes, or the amount of time between readings of this measurement.
Measurement Data	3 for each sensor reading	Sensor data encoded 6 bit binary.
Additional	Variable	If more than one measurement was setup for

Measurements		transmission, more data will follow. Each measurement setup will have data starting with the Measurement Delimiter and ending with Measurement Data.
Final Delimiter	1	This byte is always "." and it is used to denote the end of all measurement data.
Battery voltage	1	This is the battery voltage measured prior to making the transmission. The range of the number will be -32 to +31 and can be converted to volts by multiplying by 0.234 and adding 10.6 allowing a range of 3.1 to 18.1 volts.

#### Example Pseudobinary-C message:

```

C3+ADGTU?///+BDGTU?@UI+CDGTU??~v///.L
Group          3 format C
Sequence       A      1
Julian Day     DG     263
Time          TU     21:41
Interval      ?      00:-1
Data:         ///    missing
Sequence       B      2
Julian Day     DG     263
Time          TU     21:41
Interval      ?      00:-1
Data:         @UI    1353
Sequence       C      3
Julian Day     DG     263
Time          TU     21:41
Interval      ?      00:-1
Data:         ?~v    -74
              ///    missing
Batt V         L      13.4

```

#### Six-Bit Binary Encoded Format

The six bit binary format is used to encode numbers into displayable ASCII characters. Notice that fractional numbers cannot be represented, so for instance a battery voltage of 13.04 volts set up with 2 right digits will be sent as 1304.

- A 1 byte encoded number can range from -32 to +31.
- A 2 byte encoded number can range from -2048 to +2047
- A 3 byte encoded number can range from -131072 to +131071

Binary encoded numbers are always sent most significant bytes first. The number itself is broken down into 6-bit digits, and each digit is placed in one byte of data. The number 64 (ASCII "@") is added to each digit to make it fall within the range of displayable

ASCII characters. The only exception is that 127 (ASCII <DEL>) is sent as 63 (ASCII "?")

**Example 1.** Encoding the number 10 in 1 byte:

Since 10 will fit in 6-bits we only have to add 64 which would yield 74. So the number 10 would appear as ASCII 74 or the letter "J".

**Example 2.** Encoding the number 12345 in 3 bytes:

First we have to convert 12345 into binary in 6-bit pieces:

$$12345 \text{ (base 10)} = 11\ 000000\ 111001 \text{ (base 2)}$$

Now we can convert each piece back to base 10:

$$11\ 000000\ 111001 \text{ (base 2)} = 3, 0, 57$$

Finally, we add 64 to each piece and convert to ASCII:

$$67, 64, 121 = \text{ASCII "C@y"}$$

**Example 3.** Encoding the number -12345 in 3 bytes:

First we have to convert -12345 into two's complement 18-bit binary: -12345 (base 10) = 111100 111111 000111 (base 2)

Now we can convert each piece back to base 10: 111100 111111 000111 (base 2) = 60, 63, 7

Finally, we add 64 to each piece and convert to ASCII (since the second piece is 63 we leave it alone):

$$124, 63, 71 = \text{ASCII "|?G"}$$

**Example 4.** Decoding the 3 byte string "@SW":

This is just like encoding except we follow the steps backward.

First we convert all the characters to ASCII decimal codes:

$$\text{ASCII "@SW"} = 64, 83, 87$$

Now we subtract 64 from each piece and convert to 6-bit binary:

$$0, 19, 23 = 000000\ 010011\ 010111$$

Finally, we combine all the bits to form one 18-bit two's complement number and convert to base 10:

$$000000010011010111 = 1239$$

### **Pseudobinary-B/C over SMS Format**

The Pseudobinary-B and -C formats contain 8 characters which cannot be sent over SMS using the standard GSM 7-bit character set without inserting additional characters. This is undesirable as it would reduce the number of bytes that can be sent over SMS from 160 to 80 (in the worst case). To work around this limitation, SMS messages that contain a Pseudobinary message will automatically be translated to replace non-supported

characters with supported characters. Please note that this requires that the characters be translated back upon reception and before they can be passed to a decoder.

The following table describes the character translation that's performed:

ORIGINAL		REPLACEMENT	
HEX	CHAR	HEX	CHAR
5B	[	31	1
5C	\	32	2
5D	]	33	3
5E	^	34	4
60	`	35	5
7B	{	36	6
7C		37	7
7D	}	38	8
7E	~	39	9

## SHEF and SHEFFIX Formats

“SHEF” format conforms to NESDIS Standard Decimal format specifications. The format is ASCII and readable by persons without the aid of a computer.

The standard decimal format is human readable while binary formats require some processing before the values can be read. The standard decimal format is generally twice as long as the binary transmission. This means that less data can be sent in the same amount of time using the standard decimal format.

An example of a standard decimal format message is shown below. This message comes from a station with three sensors in the self-timed group. The sensors have been named HG, PC and TA. The battery voltage is the voltage of the battery just prior to transmission.

```
:HG 0 #15 10 .20 10 .15 :PC 0 #15 50 49 :TA 0 #15 -22.
```

Precip Temperature Battery

Older gauge reading (by data interval time)

Newest gauge reading

Data Interval

Offset Time

Gauge Height

The names HG, PC, TA and VB used in the transmission are called SHEF Physical Element codes (PE codes) and are the names given to the outputs in the 8310. Be sure to change the output names if you want specific codes sent in the transmission. NESDIS has a recommended list of SHEF PE codes on its website at <http://noaasis.noaa.gov/DCS/htmfiles/schefcodes.html>

“SHEF Fixed” is a special version of the SHEF format where numbers are fixed to seven decimal points.

### **SSP Format**

“SSP” is a binary format following the specifications of the Sutron Standard Protocol, which is useful when transmitting to XConnect or Tempest master stations.

If you are interested in knowing more about the low-level details of the protocol, please contact Sutron Customer Service.

### **Text Format**

The Text format is an ASCII, human readable format intended to convey the current status of the sensors, quality, and alarm state. It is similar in format to the “SHOW” command, and is intended for alarm messages. It’s also the default format for SMS Alarm messages when SMSAlarmsEnable are enabled. Sensor readings are separated by <CRLF>, while fields in the sensor data are separated with a space.

An example of a Text format message:

```
RTU01 12:22<cr><lf>
STAGE 4.55 G H+R+<cr><lf>
RAIN 2.0 G OK<cr><lf>
```

The message begins with the station’s name (“RTU01”) and the current time in HH:MM (12:22) format followed by a list of sensor readings containing the name of the sensor (“STAGE”), the value (“4.55”), the quality (“G”), and the alarm status (“H+R+”).

In the above example "H+R+" indicates that STAGE is experiencing a high limit and high rate of change alarm, while the “OK” status for RAIN indicates that it is within expected limits.

Quality codes:

G: Good quality

B: Bad quality

U: Undefined quality

Alarm codes:

H: High limit exceeded

L: Low limit exceeded

R: High Rate of change

OK: Normal

A “+” after a code indicates that the sensor has just entered that state, while a “-” after a code indicates that the sensor has just exited that state.

## **GPRS Session Protocol**

GPRS follows a protocol when sending self-timed and alarm transmissions that permits the server to issue commands. This protocol is often referred to as, "Session Type 0". The protocol helps support communications to a device which has a non-routable IP address, as many IP cell modems provide. Session Type 0 does not apply to SSP transmissions.

The following is a description of the protocol:

### **Course of Events**

1. Logger connects to Main or Backup Server
2. Logger sends Session Type Code<cr> (see below)
3. Logger sends StationName<cr>
4. Logger sends Report Type Code<cr> to indicate purpose of connection (see below)
5. Logger sends scheduled (or alarm) transmission data (if any)
6. Logger sends ETX (0x03) to mark end of data
7. Logger sends a 3 byte pseudobinary encoded CRC16 of previous data and a shared secret
8. Server sends user login command, !login=username,password<cr> and waits for logger reply (ETX)
9. If user login matches, logger enters command-line session (see operational details, below)
10. Server issues pending commands, and Logger processes and responds accordingly
11. When command processing complete, the Server disconnects

### **Session Type Code**

"Session type" defines the processing that occurs on connection. Currently, there is only one session type, "0". This type is defined by the Course of Events above, and details that follow.

"0" = defined by Course of Events, above

### **Report Type Code**

"Report Type code" describes the purpose of the transmission:

"0" = self-timed

"2" = entering alarm

"4" = exiting alarm

"6" = no data, command session only

### **Command-line Session Details**

The server may precede each command with a "!" to signal machine mode

When processing a command in machine mode, the logger:

- Suppresses the command echo
- Uses ETX (0x03) as the command prompt (i.e., follows the command response with ETX, rather than the normal command prompt)
- Inhibits pagination (doesn't pause to wait for user input after outputting a full "page" of data)

### **Alternate Paths**

Following send of ETX, logger disconnects the user specific timeout.

Sixty (60) seconds is permitted for login. Logger disconnects on failed login.